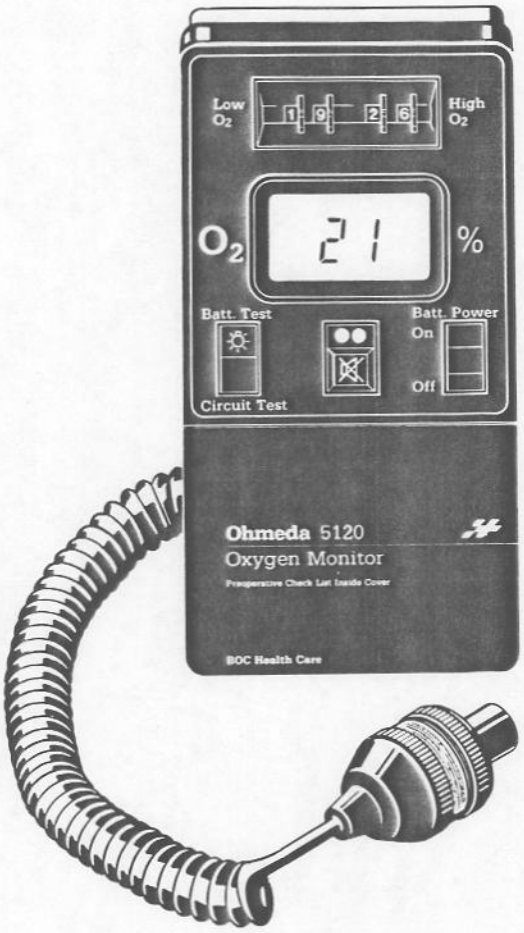
5120 Oxygen Monitor

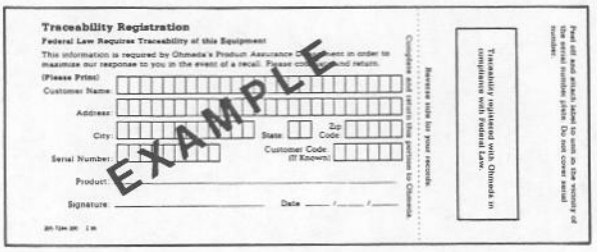
Operation and Maintenance Manual



USER RESPONSIBILITY

This Product will perform in conformity with the description thereof contained in this operating manual and accompanying labels and/or inserts, when assembled, operated, maintained and repaired in accordance with the instructions provided. This Product must be checked periodically. A defective Product should not be used. Parts that are broken, missing, plainly worn, distorted or contaminated should be replaced immediately. Should such repair or replacement become necessary, Ohmeda recommends that a telephonic or written request for service advice be made to the nearest Ohmeda Regional Service Center. This Product or any of its parts should not be repaired other than in accordance with written instructions provided by Ohmeda and by Ohmeda trained personnel. The Product must not be altered without the prior written approval of Ohmeda's Safety Department. The user of this Product shall have the sole responsibility for any malfunction which results from improper use, faulty maintenance, improper repair, damage, or alteration by anyone other than Ohmeda.

TRACEABILITY: Federal law in the U.S.A. requires traceability of this equipment. Please fill out the self-addressed traceability registration card included with this product and return it to Ohmeda. If additional cards are required, order Stock Number 6050-0000-134.



CAUTION: Federal law in U.S.A. and Canada restricts this device to sale by or on the order of a licensed medical practitioner.

NOTE: Storage Inspection Requirements - Inspection of units in storage should be performed at 30 month intervals. Use MIL-STD 105D for unit sample size. Follow the Preoperative Checkout Procedure in Section 3.

NOTE: Perform preventative maintenance for units in service quarterly (every 4 months). Follow the Preoperative Checkout Procedure in Section 3.

NOTE: Storage Inspection Requirements - Inspection of units with oxygen monitor sensors should be performed at 12 month intervals. Use MIL-STD 105D for unit sample size. Follow the Preoperative Checkout Procedure in Section 3.

NOTE: The 5120 Oxygen Monitor should be stored in a clean dry enviroment with temperatures not to exceed -28°C to +54°C (-20°F to 130° F).

NOTE: To maximize the oxygen monitor sensor s shelf life, when refrigeration is not available, the sensor should be stored in a clean and dry enviroment at:

Temperature: -20°C (68 F) +/- 2°C
Humidity: 55% +/- 5%

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PRECAUTIONS

⚠ WARNINGS:

Connect only a high impedance device (at least 10 K ohms) to pin 5 of the output connector. Improper loading will result in an output voltage that is lower than the corresponding value displayed by the oxygen monitor. See page 24.

If the monitor fails to respond as described in the Preoperative Checkout Procedure, do not use it until the malfunction has been corrected. See Pages 29 and 36.

⚠ CAUTIONS:

When in use, the sensor should always be pointing down to reduce moisture build-up on its sensing surface. See Page 31.

Use the recommended cleaning solution sparingly; do not saturate or immerse the monitor. See Page 36.

Do not gas sterilize the monitor. See Page 36.

Do not autoclave the monitor. See Page 36.

Following sterilization with ethylene oxide of the probe housing (front half only) of the tee manifold, or of the sensor cartridge, quarantine parts to allow dissipation of residual ethylene oxide gas absorbed by the material. Follow sterilizer manufacturer's recommendations for procedure and aeration period. See Page 37.

Only competent individuals trained in the repair of this equipment should attempt to service it. See Page 39.

Detailed information for more extensive repairs is included in the service manual solely for the convenience of users having proper knowledge, tools and test equipment, and for service representatives trained by Ohmeda. See Page 39.

After replacing the sensor cartridge or the sensor assembly, perform the Preoperative Checkout Procedure in Section 3.1 to verify that the monitor is working properly. Allow at least five minutes to stabilize the sensor; refer to the NOTE on page 28. See Page 43.

After fresh batteries are installed, perform the Preoperative Checkout Procedure in Section 3.1 to verify that the monitor is working properly. See Page 46.

INTRODUCTION

This manual contains information that will guide you to properly prepare, operate, and maintain the Ohmeda 5120 Oxygen Monitor.

Read through the entire manual before using the monitor. Pay special attention to the Warnings and Cautions which appear throughout this manual and are summarized in the PRECAUTIONS section.

Read the User Responsibility statement; it lists what is expected of the user to maintain a safe and accurate instrument. Read the Warranty; it lists Ohmeda's responsibility in case of a functional defect.

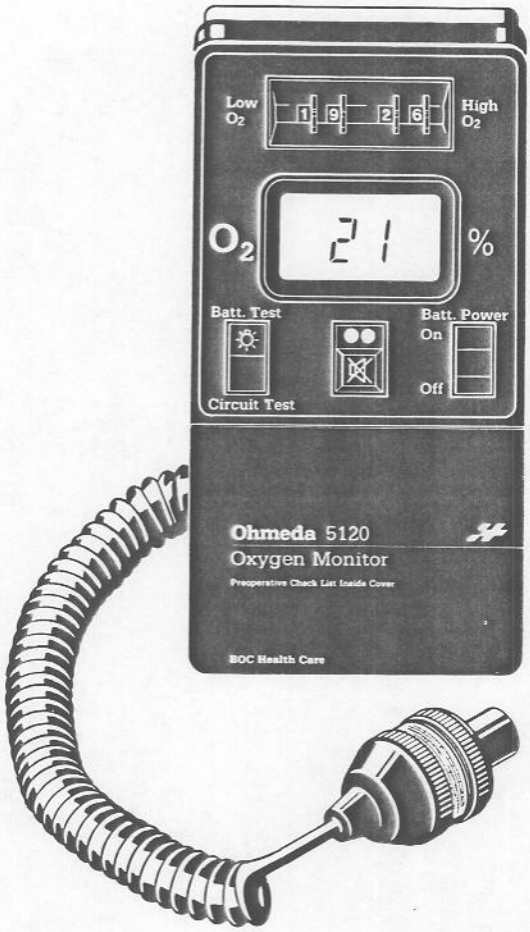
The oxygen sensor cartridge is a consumable item with a limited service life affected by several factors. Read the Sensor Life Expectancy statement (on page 5) about proper handling and storage of the sensor to realize maximum service life.

Keep this manual available for answering questions which may arise concerning the monitor's operation, its maintenance, or in case of failure, its repair.

System Installation (Modulus II Anesthesia System)

The 5120 Oxygen Monitor is a stand-alone unit which can be carried from place to place as required. However, its compact size makes it an ideal module for use in a larger system such as the Modulus II Anesthesia System. In either case, except for a few considerations explained in referenced footnotes, the operation of the monitor is identical as a stand-alone or as a system unit.

Consult the Modulus II Anesthesia System Operation and Maintenance Manual for information regarding the interconnection between the monitor and the rest of the system.



Stock Number 0304-2179-810 (stand-alone)
Includes standard accessories as listed in section 1.2

Stock Number 0304-2180-980 (standard with Modulus II)
Includes standard accessories as listed in section 1.2
(less probe holder and universal mounting clamp)

Figure 1. Ohmeda 5120 Oxygen Monitor

1.0 GENERAL INFORMATION

This section describes the general features of the monitor (1.1), illustrates the accessories supplied with it (1.2), includes a theory of operation (1.3), and lists detailed specifications (1.4).

1.1 Description

The 5120 Oxygen Monitor (refer to Figure 1 on page 2) can be used throughout the hospital: in anesthesia, in respiratory therapy, in the nursery, or wherever a measurement of oxygen concentration is required.

The 5120 Oxygen Monitor features a LIQUID CRYSTAL digital DISPLAY (LCD) that indicates oxygen concentrations from zero to 100 percent. The digits are large (1.3 cm, 0.5 inches, high) for easy viewing. Additional features include:

- A switch-operated backlight for viewing in subdued light(*).

- A digital switch to select High O2 and Low O2 alarm limit set points.

  Setting the Low O2 alarm limit below 18% results in three beep tones and a continuous visual indicator (yellow). The monitor does not accept low alarm limits below 18%. The monitor will alarm whenever the displayed O2 reading is below 18% O2 regardless of how far below 18% the Low O2 alarm limit is set.

  Setting the High O2 alarm limit switch to "00" disables the High O2 alarms, a feature useful during 100% oxygen flush procedures.

- Visual and audible alarms to warn of a low or a high oxygen concentration. The alarms respond whenever the displayed oxygen concentration is less than or greater than the selected limits.

  For a Low O2 alarm condition, the audible alarm can be silenced for approximately 30 seconds. For conditions other than Low O2, the audible alarm may be silenced with the Alarm Silence switch, and will remain silenced for the duration of the alarm condition. The visual indicators remain active throughout any alarm condition.

(*) The backlight is always on when the monitor is powered by an external source; for example, a Modulus II Anesthesia System.

- A sensor assembly which attaches to the monitor with a coiled cable that extends to approximately 6 feet.

- A long-life oxygen cartridge which can be easily replaced in the sensor assembly without tools.

  The sensor includes an internal thermistor for temperature compensation. The sensor's accuracy is not noticeably affected when exposed to carbon dioxide, nitrous oxide or other normally used anesthesia gases. The sensor is also insensitive to humidity when monitoring a humidified gas stream (95% R.H. non-condensing).

- A hinged, front cover that opens for easy access to

  -- a Preoperative Checklist,

  -- the calibration control,

  -- and, for replacement, the batteries.

- Two modes for testing the internal batteries(*).

  -- a manual test initiated by the operator,

  -- and a test performed automatically by the monitor, which, as applicable, either indicates limited remaining battery life (LOW BATT), or, if the batteries are discharged below a useful level, halts operation until the batteries are replaced.

- A front panel switch (CIRCUIT TEST) which electronically substitutes a sensor signal simulating a high concentration of oxygen (88 to 102 %).

  The circuit test verifies that the digital display, the displayed messages, and the visual alarm indicators (LEDs) are functional.

- A modular connector (Output) at the back of the monitor provides the following for remote monitoring equipment.

  -- an analog signal proportional to the oxygen concentration

  -- a digital output signal indicating an alarm condition

  -- an external alarm silence input for remote silence capability.

(*) The battery tests are not valid if the monitor is powered by an external source; for example, when installed in a Modulus II Anesthesia System. See item 3 on page 18.

ATTENTION
SENSOR LIFE EXPECTANCY

The service life of this high-quality oxygen sensor is affected by storage time and conditions, as well as the percent oxygen the sensor is exposed to while in service.

This sensor will typically function for approximately 438,000 percent hours. For example, it would typically last for one year at 50% oxygen or 6 months at 100% oxygen. (Continuous exposure to CO2 may also shorten the expected life of the sensor.)

STORAGE

This sensor is packaged in an inert atmosphere to maximize shelf-life. Do not puncture or open the package prior to placing the sensor in service.

This sensor has a finite shelf-life which will vary depending on storage conditions. Reduced temperatures and increased relative humidity will help prevent the sensor from drying out and, thus, enhance its shelf-life. Placing unopened sensors in a refrigerator (Temp. 6 C +/- 3 C) should extend the shelf-life. DO NOT FREEZE.

1.2 Accessories

Several Standard Accessories are supplied with the oxygen monitor; refer to Figure 2. Note that the probe holder and the universal mounting clamp are not included with monitors that are built into a system such as the Modulus II Anesthesia System.

A dome adapter kit and a sensor cord extension kit are available as optional accessories; refer to Figure 3 on page 7.

A. Standard Accessories:

The 22 mm Tee Manifold adapts the 15 mm sensor probe to the patient airway circuit.

If the monitor is to be used as a portable unit, the probe holder provides a convenient place to keep the sensor probe when not in use.

If the monitor is to be used in a "permanent" location (not built into a system), use the universal mounting clamp to attach the monitor to a convenient shelf or pole.

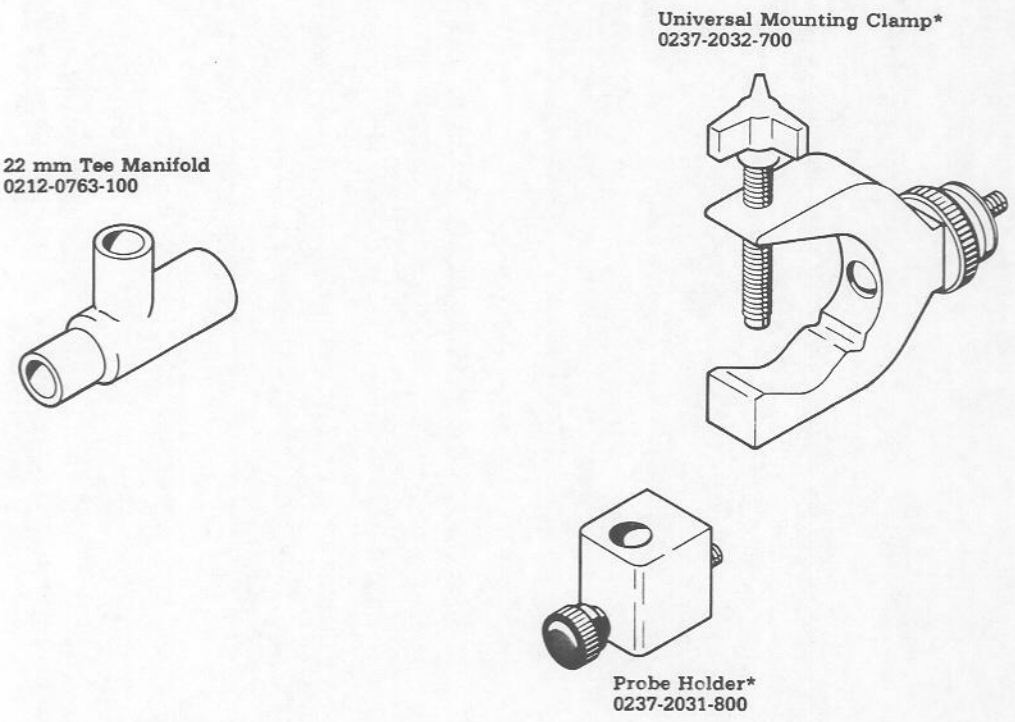


Figure 2. Standard Accessories
Items marked with asterisk (*) are not supplied with system installations.

B. Optional Accessories:

The Dome Adapter Kit provides a patient airway sensing port at the Inhalation Check Valve of an Ohmeda Absorber.

The Sensor Cord Extension Kit increases the reach of the Sensor Assembly by six feet (12 feet total).

The six-pin Duplex Jack allows two parallel connections to the Output Connector for special applications.

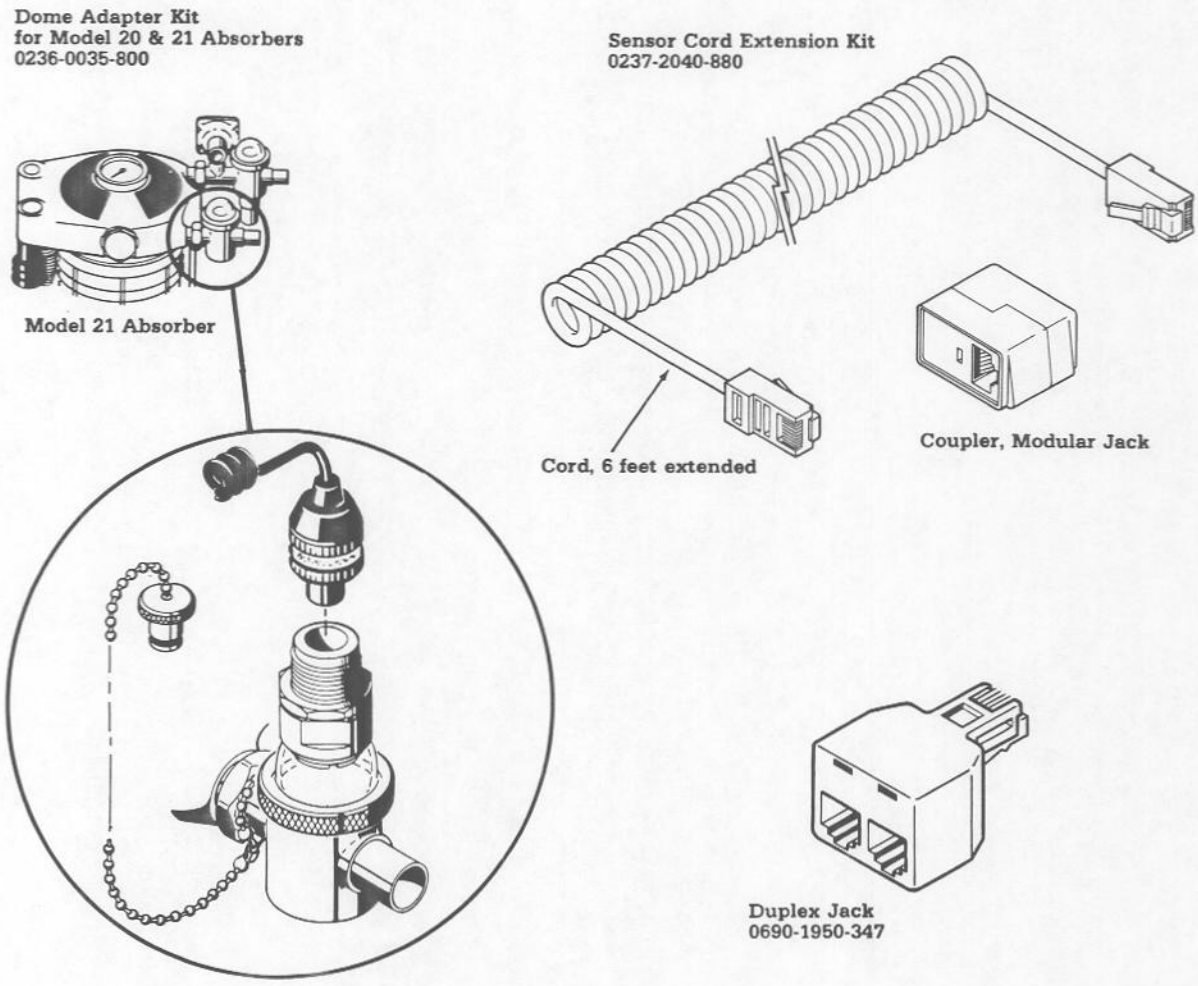


Figure 3. Optional Accessories

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1.3 Theory of Operation

The sensor assembly contains an oxygen sensing cartridge which produces a voltage that is proportional to the oxygen concentration (partial pressure) at its detecting surface.

The sensor cartridge is an electrochemical device (galvanic cell). Oxygen diffuses through a membrane into the cell and oxidizes (chemical reaction) a base metal electrode. The resultant oxidation current (electrical) is proportional to the partial pressure (concentration) of the oxygen. The base metal electrode is gradually consumed (worn out) by the chemical process.

The output voltage from the sensor cartridge is affected by the temperature of the monitored gas mixture. A thermistor in the sensor housing compensates for temperature changes.

The monitor assembly contains sophisticated signal processing and analyzing circuitry which converts the sensor signal into a corresponding percent oxygen display. The displayed value is compared to programmed limits and if required, appropriate alarms are generated.

The block diagram in Figure 4 on page 9 details the relationship between the circuit components described below.

SENSOR ASSEMBLY	- produces a signal proportional to the monitored oxygen concentration.
A/D CONVERTER	- converts the signal from the sensor (analog) to a digital form required by the microprocessor.
MICROCOMPUTER	- receives inputs from the oxygen sensor, the operator-controlled switches and the power circuitry.
	- compares measured values to set limits.
	- updates the digital Display.
	- generates an audible alarm and visual alarm indicators if an alarm condition is sensed.
	- generates output signals for remote monitoring.
DISPLAY (LCD)	- converts digital information from the microprocessor to its visual alphanumeric equivalent.
SWITCH INPUTS	- provide an operator interface to the microprocessor.

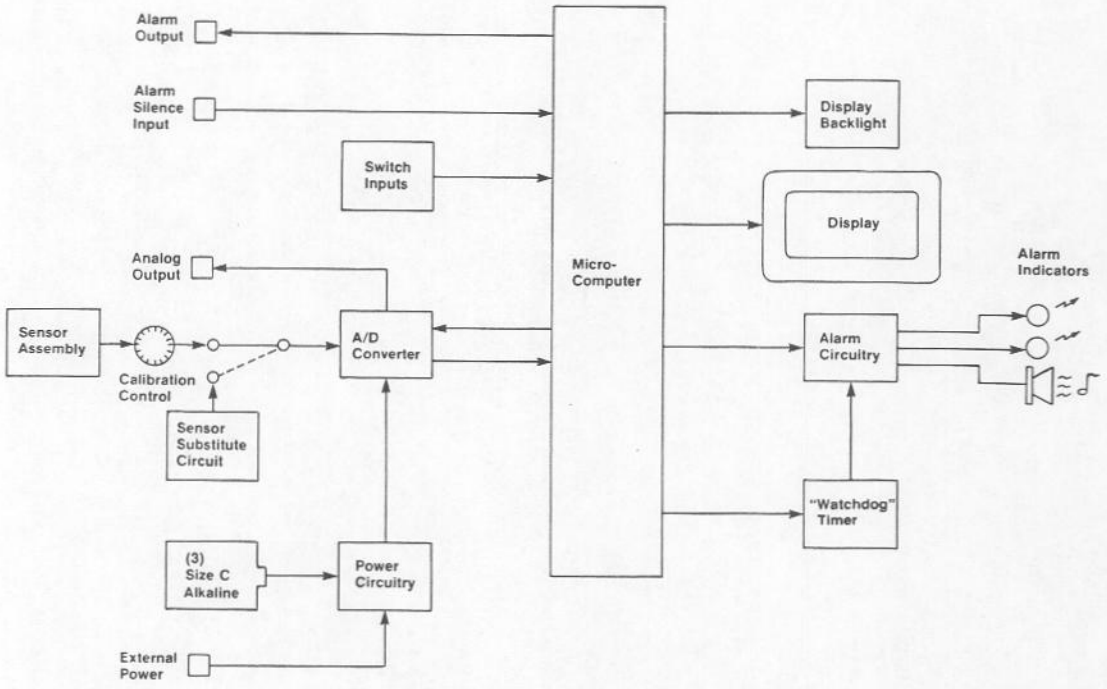


Figure 4. 5120 Oxygen Monitor Block Diagram

ALARM CIRCUITRY - generates audible alarms and visual alarm indicators based on microprocessor, operator and "Watchdog" circuit inputs.

"WATCHDOG" TIMER - issues an alarm condition if a system (monitor) failure is sensed.

DISPLAY BACKLIGHT - improves LCD Display visibility in low ambient light.

POWER CIRCUITRY - regulates battery power or power from an external source (such as a Modulus II Anesthesia System).

SENSOR SUBSTITUTE CIRCUITRY - produces a signal that simulates a high concentration of oxygen for the operator-initiated circuit test.

1.4 Specifications

DISPLAY TYPE:	LCD (Liquid Crystal Display)
RANGE:	0 to 100% Oxygen
DISPLAY RESOLUTION:	1% of full scale reading
DISPLAY UPDATE:	3 times a second
RESPONSE TIME, TYPICAL:	90% of total change in oxygen concentration in less than 15 seconds at 25 C (77 F)
DRIFT RANGE:	+/- 1% over an 8 hour period
MONITOR LINEARITY:	+/- 1% of full scale
OPERATING TEMPERATURE RANGE:	+5 C to +40 C (41 F to 104 F)
TEMPERATURE COMPENSATION RANGE:	+15 C to +40 C (59 F to 104 F)
SENSOR LIFE:	12 months, typical; assumes average % O2 equal to 50% at +25 C (+77 F)

ALARM SYSTEM:

VISUAL
- -- Alphanumeric messages indicating oxygen concentration out of selected limits: HIGH O2 and LOW O2.
- -- Alphanumeric messages indicating battery condition: BATT OK and LOW BATT.
- -- Continuously lit or intermittently flashing alarm indicators (red or yellow Light Emitting Diodes - LEDs) determined by alarm condition.

AUDIBLE
- -- Oscillating two-tone (2 kHz/1 kHz),
- -- continuous low tone (1 kHz),
- -- intermittent low tone, or a
- -- 3-beep low-tone,

determined by alarm condition.

ALARM SILENCE
- -- For Low O2 condition, the audible alarm can be silenced for 30 seconds.
- -- For conditions other than Low O2, the alarm is silenced for the duration of the alarm condition if the alarm silence key is pressed.

Note: Setting the Low O2 alarm limit below 18% results in three beep tones and a continuously lit alarm indicator (yellow). Although the Low O2 alarm limit can be physically set to below 18%, the monitor issues a LOW O2 alarm whenever the O2 level falls below 18%, regardless of the low limit switch setting.

POWER REQUIREMENTS:	Three size C alkaline batteries
DRAIN:	Typical current, 3.5 milliamps at 4.5 volts (assumes no alarms or use of backlight)
BATTERY LIFE, NOMINAL:	1300 hours; eight weeks continuous use (24 hours a day); (assumes no alarms or use of backlight)
BATTERY TEST:	Manual and Automatic
ANALOG OUTPUT:	10 mV/%O2 at 10 K ohms minimum load impedance
DIMENSIONS:	Depth: 6 cm (2.25 inches) Width: 9 cm (3.50 inches) Height: 17 cm (6.75 inches)
WEIGHT:	0.6 kg (1.3 lbs) without sensor

2.0 SETUP AND CALIBRATION

This section tells you how to set up the monitor when you first receive it (2.1), shows you how to attach the probe holder or the universal mounting clamp (2.2), identifies the controls and components you will be using while operating the monitor (2.3), describes the alarms the monitor generates to warn you of specific conditions (2.4), and includes a calibration procedure to follow regularly to ensure the accuracy of the displayed readings (2.5).

2.1 Setup

As received, the 5120 Oxygen Monitor is fully assembled, however, batteries must be installed and the sensor assembly must be attached to the monitor. If the monitor is part of a Modulus II Anesthesia System, the monitor should be ready for operation.

Note: Read the operating instructions in Section 3.2 before using the monitor.

1. Install three, size C, alkaline batteries as outlined in Section 5.3C, omitting Step 3.

   NOTE: Three, Size C, alkaline batteries are included for your convenience. Since all batteries have a limited shelf-life, no guarantee can be made as to their service life. Replace with fresh, Size C, alkaline batteries.

2. Attach the sensor assembly to the monitor as described in Section 5.3A.

3. Install the sensor cartridge into the sensor assembly probe housing as described in Section 5.3B.

2.2 Mounting

The 5120 Oxygen Monitor can be used as a portable instrument or mounted on a post or bar (shelf) in the area of intended use (*).
Two accessories are provided, one for each situation.

A. PORTABLE: Refer to Figure 5.

If the monitor is used as a stand-alone unit, a holder is provided to protect the sensor probe while the monitor is not in use.

Align the probe holder with the retaining pin and the threaded mounting hole in the back of the monitor.
Screw the bolt in firmly (finger-tight); do not use tools.

B. MOUNTED: Refer to Figure 6.

If the monitor is to be placed in a permanent location (not built into a system), attach the universal mounting clamp as described below. The clamp can be attached to a shelf up to 4 cm (1-5/8 inches) thick or a pole up to 5 cm (2 inches) in diameter.

The monitor attachment and the clamp are held together by a ball joint which can be swiveled 25 degrees in any direction. Tighten the large retaining nut to lock the ball joint in place. Screw the mounting clamp into the threaded hole in the back of the monitor; ensure a firm grip between the clamp and the monitor housing.

Attach the clamp to the shelf or pole where the monitor is to be used. Loosen the large retaining nut to free the ball joint. Position the monitor to the desired viewing angle. Tighten the large retaining nut to hold the monitor in place.

(*) The oxygen monitor can also be installed in systems: such as the Modulus II Anesthesia System. Refer to the System's manuals for details.

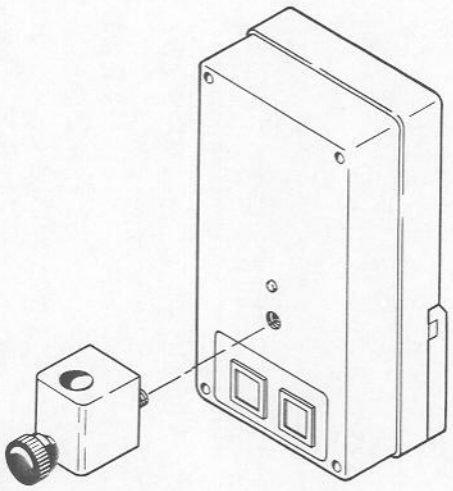


Figure 5. Probe Holder

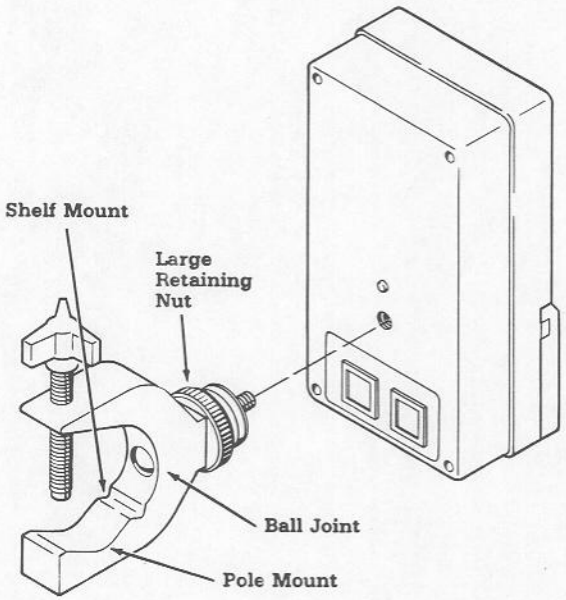


Figure 6. Universal Mounting Clamp

2.3 Controls and Components

This section identifies the controls and components encountered during the operation and maintenance of the 5120 Oxygen Monitor. Functions are defined and their effects on the total system are described.

(Refer to Figure 7 on page 17)

1. BATTery POWER Switch: This is a two position rocker switch used to turn the monitor's battery power on and off.

   Note: If the monitor is installed in a system, such as the Modulus II Anesthesia System, the battery power switch must be set to the OFF position if the monitor is to be operated from the external power source provided by the system connection. If the BATTery POWER switch is in the ON position and the external power source is then turned off, an intermittent low tone alarm will sound, indicating that the monitor has been inadvertently left on battery power. Turn the BATTery POWER switch OFF to prevent this alarm.

   Normally the monitor is ready for operation as soon as the power is turned on; no warm-up or standby is required. However, if the sensor assembly has been disconnected from the monitor, or if the sensor cartridge has been replaced, allow at least five minutes to stabilize sensor. Refer to the note on page 28.

1A. Automatic Battery Test: Whenever the monitor's Battery Power switch is first turned on (and periodically thereafter) the condition of the batteries is tested automatically and a corresponding messages is displayed; and if required, an an audible alarm is generated(*).

   a. If the batteries are fresh (size C, alkaline) the monitor operates for at least 1,300 hours (assuming no alarms or use of backlight); this is equal to eight weeks of continuous, 24 hour a day, operation. The monitor displays a "BATT OK" message if the condition of the batteries will allow more than 8 hours of continuous operation.

   b. When the batteries reach the end of their useful life, the monitor displays a "LOW BATT" message, lights the yellow (LED) indicator, and sounds 3 low-tone beeps. Although the monitor should continue to operate properly for approximately 6 hours (assumes no use of backlight), replace the batteries to ensure uninterrupted monitoring.

(*) If the monitor is installed in a system, such as the Modulus II Anesthesia System, the internal batteries (because the battery power switch should be left in the Off position whenever the monitor is powered by an external source) are not tested automatically. To determine the condition of the internal batteries, perform the manual battery test as described in item 3 on page 18.

c. If the battery power is below an acceptable threshold, the monitor goes into a "shutdown" mode:

- an audible alarm sounds (intermittent low-tone),
- the yellow alarm indicator (LED) flashes,
- the LOW BATT message appears on the display, and
- the digital display is blank.

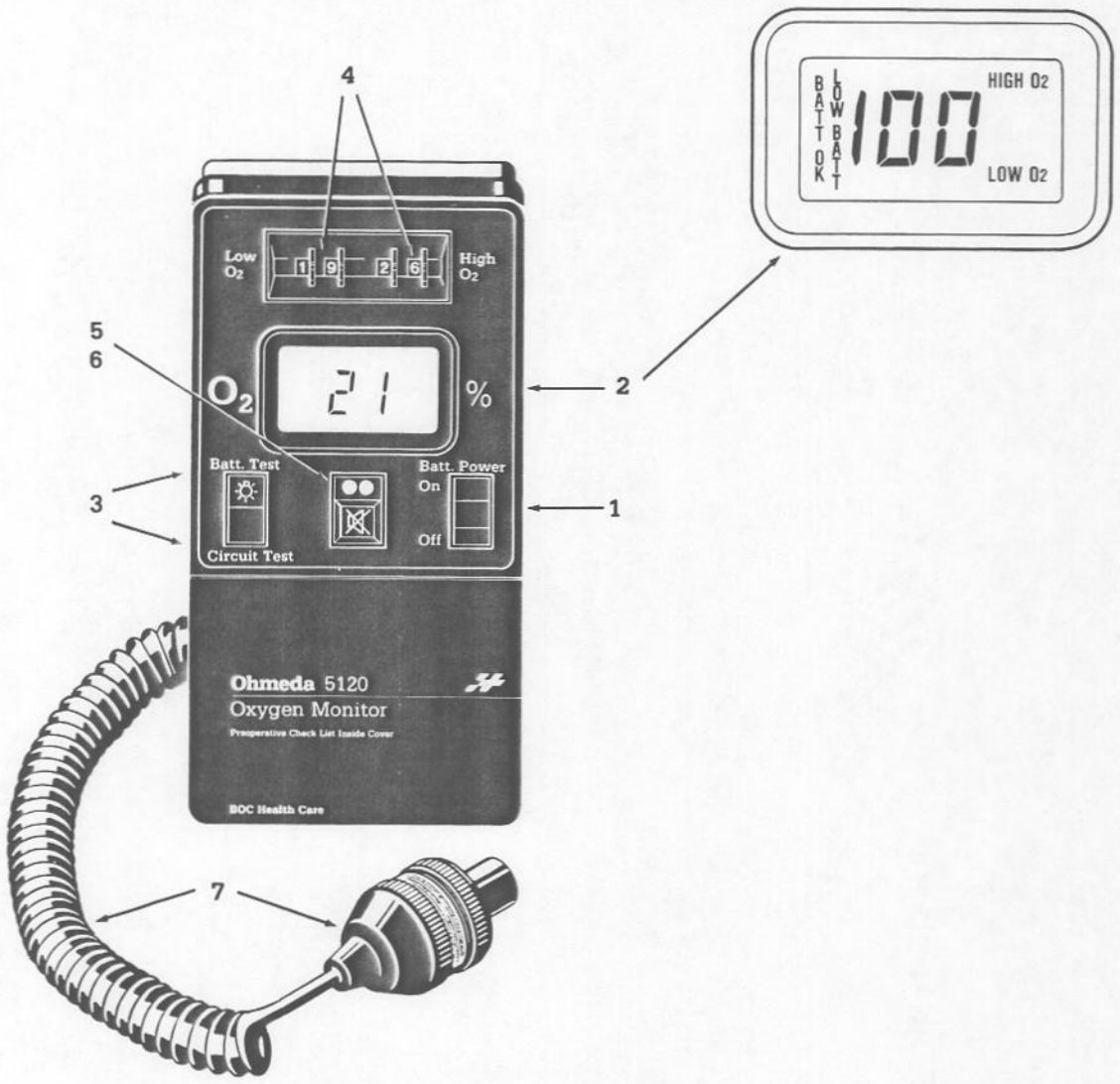


Figure 7. Oxygen Monitor, Front View

2. DISPLAY: The oxygen monitor uses a Liquid Crystal Display (LCD) to show the concentration of oxygen in numeric form. The LCD also displays alphanumeric messages for alarm conditions and battery status.

   a. The monitor displays oxygen concentrations from "00" to "100"% oxygen in 1% increments.

   b. Messages appear on the display to indicate various conditions.

      - The LOW O2 message appears whenever the displayed oxygen concentration is less than the low O2 alarm limit selected; refer to item 4 of this section.

      - The HIGH O2 message appears whenever the displayed oxygen concentration is greater than the high O2 alarm limit selected; refer to item 4 of this section.

      - The BATT OK message indicates that the batteries do not require attention at this time; refer to items 1A and 3b of this section.

      - The LOW BATT message indicates a low voltage condition of the batteries; refer to items 1A and 3b of this section.

3. BATTery TEST (☼) and CIRCUIT TEST Switch: This is a three-position switch used to turn on the backlight for viewing the display in subdued lighting, to perform a manual battery test, and to verify that the display circuitry and the alarms are operational.

   a. A Liquid Crystal Display (LCD) does not produce light. It depends on ambient light to make the digits (characters) visible. When the room light is low the display may be difficult to read. Pressing the top half of the switch activates an internal light that continuously illuminates the display. The light remains on until the switch is again pressed to turn the backlight off.

      Note: If the monitor is installed in a Modulus II Anesthesia System, the backlight is always on whenever the system is on.

   b. The condition of the batteries can be checked manually. Pressing the top half of the switch (BATT TEST) activates battery test circuitry (along with the backlight). If the LOW BATT message is displayed, replace the batteries to ensure uninterrupted monitoring of the patient.

      Note: If the monitor is installed in a Modulus II Anesthesia System, the batteries can only be tested if the external source of power is off and the BATTery POWER switch is on.

c. The electronic circuitry of the monitor should be tested periodically to verify that the digital display, the displayed messages, and the visual alarm indicators (see item 6) are functional. Pressing the bottom portion of the switch (Circuit Test) electronically substitutes a voltage simulating a high concentration of oxygen (88 to 102 %). All alarm messages are displayed and the red and yellow alarm indicators are turned on (along with one short audio alarm beep). If any of the monitor functions fail to operate during the test sequence, the monitor must not be used until repairs are made.

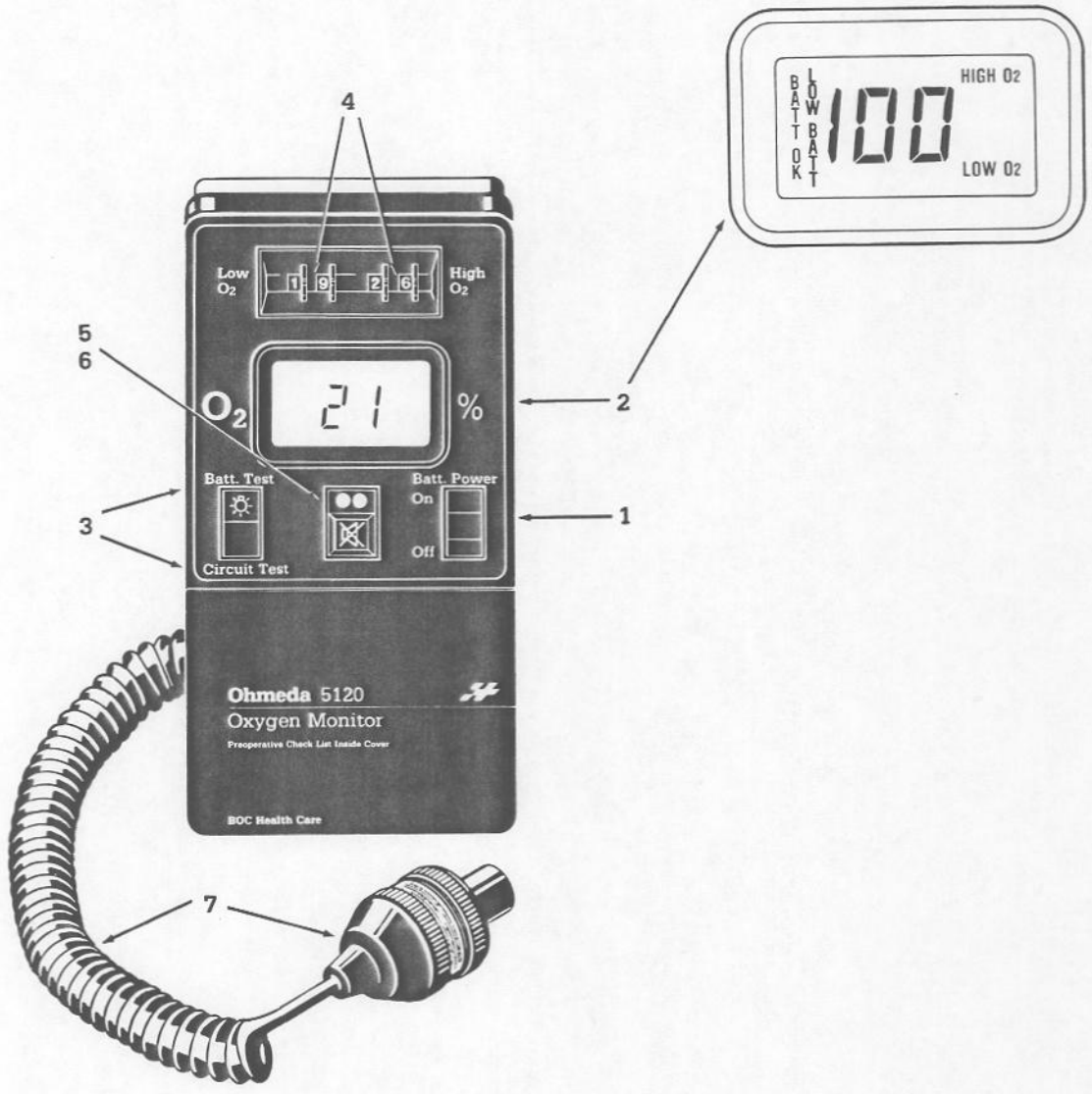


Figure 8. Oxygen Monitor, Front View (continued)

4. Alarm Limit Switches: Use these switches to set the high oxygen and the low oxygen alarm limits. When the displayed oxygen concentration is less than or greater than the values set by the Low O2 and High O2 alarm limit switch, the monitor will respond with corresponding alarms.

- LOW O2: Whenever the displayed oxygen concentration is less than the value set by the Low O2 alarm limit switch, the LOW O2 message is displayed, the red alarm indicator (see item 6) flashes and an oscillating two-tone audible alarm sounds.

  NOTE: Setting the Low O2 limit switch below 18% turns the yellow alarm indicator (LED) on, accompanied by three low-tone beeps. If the displayed concentration falls below 18%, the monitor will issue a high priority alarm (same as LOW O2 alarm) regardless of how far below 18% the Low O2 alarm limit switch is set.

- HIGH O2: Whenever a displayed oxygen concentration is greater than the value set by the High O2 alarm limit switch, the HIGH O2 message is displayed, the yellow alarm indicator (see item 6) flashes and an intermittent low-tone alarm sounds.

  Note: Setting the High O2 alarm limit switch to "00" disables the HIGH O2 alarm; this mode is useful during 100% oxygen flush procedures.

5. Alarm Indicators (☼☼): The alarm silence switch includes two Light Emitting Diodes (LEDs) to visually indicate an alarm condition.

   a. The red LED flashes whenever the displayed O2 is less than the value set by the Low O2 switch.

   b. The yellow LED flashes whenever

      -- the displayed %O2 is greater than the value set by the High O2 switch,
      -- the sensor is disconnected or defective, or
      -- the batteries have discharged below a useable level.

   c. The yellow LED is continuously lit whenever

      -- a LOW BATTery condition occurs,
      -- the Low O2 limit switch is set below 18, or
      -- a system (monitor) failure is sensed.

6. Alarm Silence Switch ( ): During a Low O2 alarm, pressing the "alarm silence" switch turns off the alarm for 30 seconds; the visual alarm indicators remain active throughout. For other than Low O2 alarm conditions, the audio alarm is silenced for the duration of the alarm condition.

   In either case, a flashing alarm indicator switches to being on continuously (not flashing) for the duration of the Alarm Silence period.

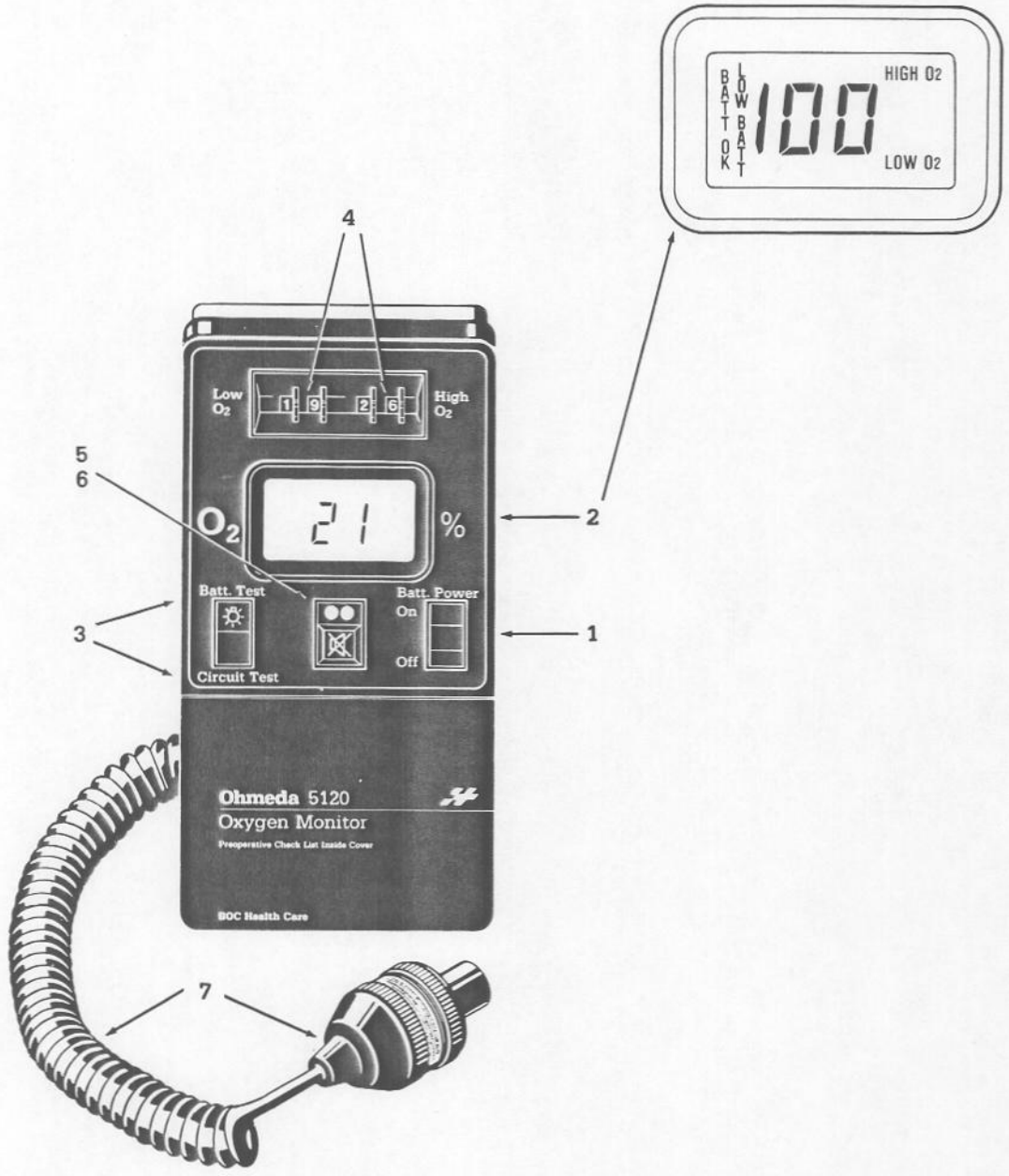


Figure 9. Oxygen Monitor, Front View (continued)

7. Sensor Assembly: The sensor assembly consists of the housing (probe) for the oxygen sensor cartridge, the coiled cable, and the connector which joins the sensor assembly to the monitor. The sensor cartridge is not part of the sensor assembly; it must be installed before use (refer to section 5.3.B).

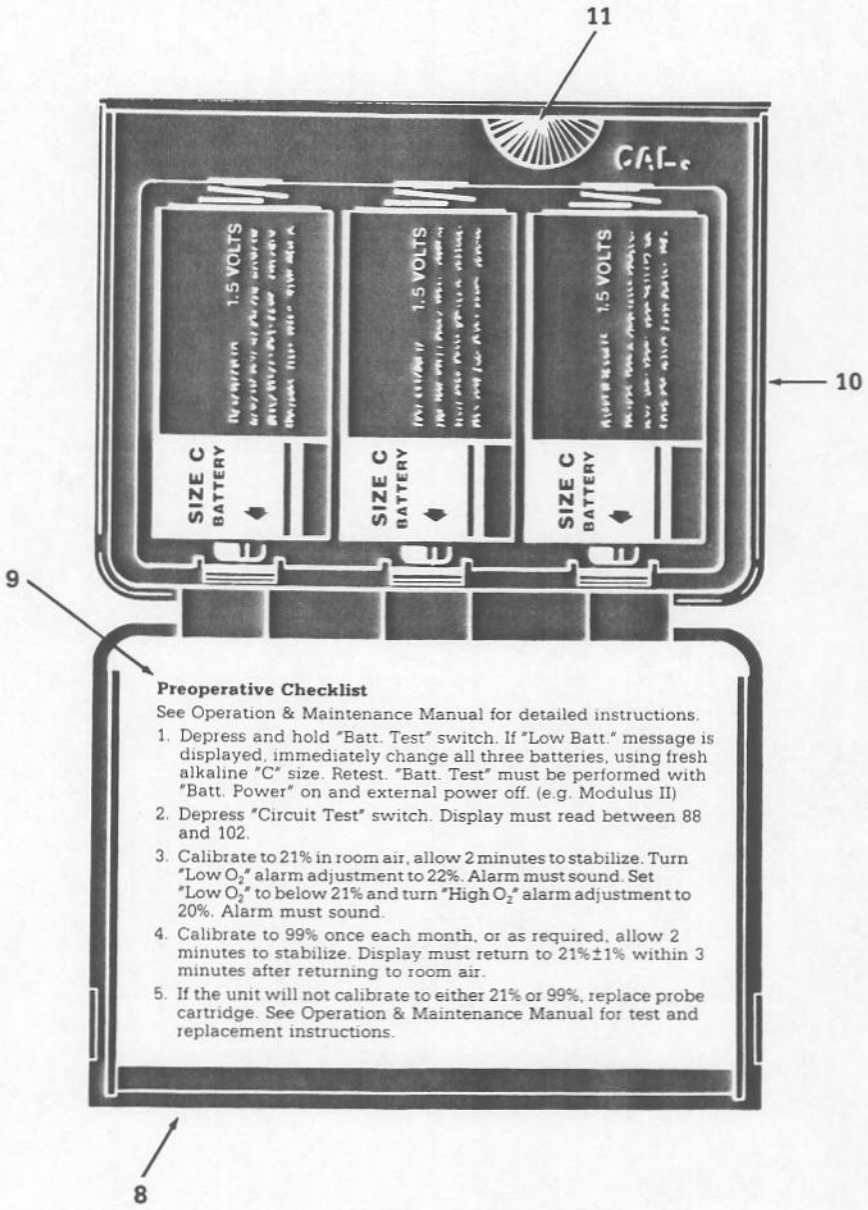

11
10
9
8
1.5 VOLTS
SIZE C BATTERY
Preoperative Checklist
See Operation & Maintenance Manual for detailed instructions.
1. Depress and hold "Batt. Test" switch. If "Low Batt." message is displayed, immediately change all three batteries, using fresh alkaline "C" size. Retest. "Batt. Test" must be performed with "Batt. Power" on and external power off. (e.g. Modulus II)
2. Depress "Circuit Test" switch. Display must read between 88 and 102.
3. Calibrate to 21% in room air, allow 2 minutes to stabilize. Turn "Low O_2" alarm adjustment to 22%. Alarm must sound. Set "Low O_2" to below 21% and turn "High O_2" alarm adjustment to 20%. Alarm must sound.
4. Calibrate to 99% once each month, or as required, allow 2 minutes to stabilize. Display must return to 21%±1% within 3 minutes after returning to room air.
5. If the unit will not calibrate to either 21% or 99%, replace probe cartridge. See Operation & Maintenance Manual for test and replacement instructions.

Figure 10. Battery Compartment

(Refer to Figure 10 on page 22)

8. Front Cover: The lower portion of the front panel flips down for easy access to the Preoperative Checklist, the batteries, and the calibration control.

9. Preoperative Checklist: The inside of the front cover contains a brief procedure to be followed daily or whenever preparing to monitor a new patient. Follow this procedure to ensure that the monitor is in operating order.
Refer to section 3.1 for the Preoperative Checkout Procedure.

10. Batteries: The oxygen monitor is powered by three, size C, alkaline batteries(*). The monitor includes an automatic and a manual battery test described in items 1A and 3b of this section. Section 5.3C describes how to replace spent batteries.

11. CALibration Control: The oxygen sensor produces a current that is proportional to the oxygen concentration monitored. The calibration control is used to set the displayed reading to match the monitored oxygen concentration. Room air (21% O2) is specified in the Preoperative Checkout Procedure.

    Similar to batteries, the output from the sensor cartridge gradually diminishes with time. The CALibration adjustment compensates for the change.

    Check the monitor periodically with a "100%" concentration of oxygen to assure the monitor's specified accuracy.
    Section 2.5 details the calibration procedure.

    The calibration control is housed behind the front panel to guard against inadvertent movement, but provides easy access when calibration is required.

(*) If the monitor is installed in a Modulus II Anesthesia System, the monitor should be operated from the system's power source (BATTery POWER switch to Off) to conserve the monitor's internal batteries.

(Refer to Figure 11 on page 25)

12. Sensor (Input) Connector: The sensor assembly cable connects to the back of the monitor through an 8-pin modular jack.

13. Output Connector: The output connector provides remote access to three features of the 5120 Oxygen Monitor:

    -- an analog output of the displayed percentage of oxygen,
    -- a digital output indicating a sensed alarm condition, and
    -- a connection for remote alarm silencing.

    WARNING: Connect only a high impedance device (at least 10 K ohms) to pin 5 of the analog output connector. Improper loading will result in an output voltage that is lower than the corresponding value displayed on the oxygen monitor.

    Refer to Appendix A for the pin connections and a detailed description of each feature.

14. MOUNTING: If the monitor is intended for portable use, attach the probe holder to this threaded insert; if the monitor is to be used in a "permanent" location, attach the universal mounting clamp instead. Refer to section 1.2, Accessories.

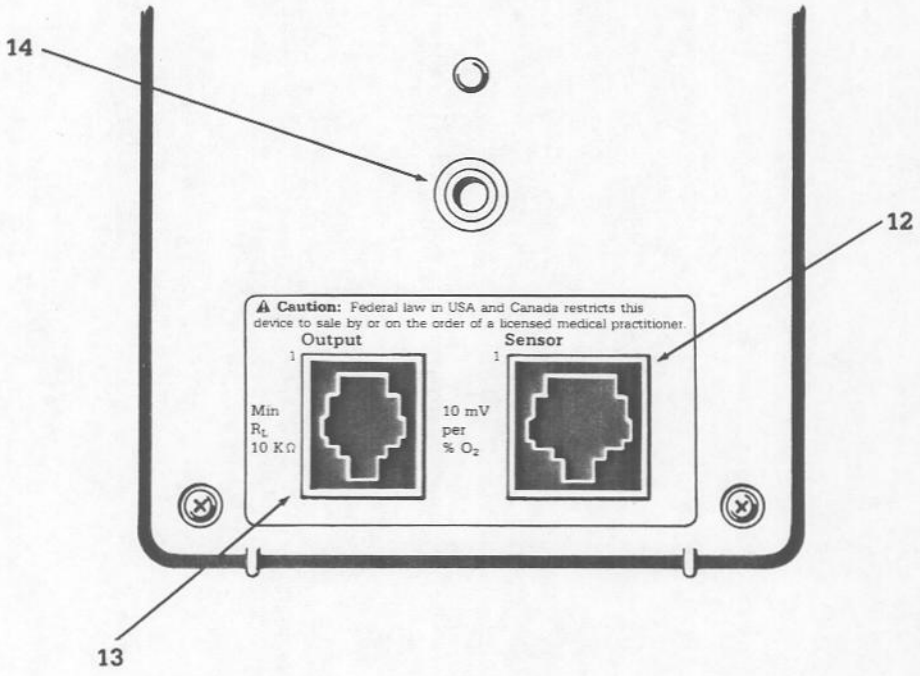


Figure 11. Rear View

2.4 Alarms

The 5120 Oxygen Monitor displays the percent of oxygen concentration present at its sensor. If the sensed values change beyond selected limits, alarms and messages are generated to alert the operator of the changed condition. The severity of the condition determines the level of alarm. The alarms are described in the following paragraphs and summarized in Chart 1 on page 38.

NOTE: Pressing the "Alarm Silence" switch turns off the audible alarm and, if flashing, causes the alarm indicator to be on continuously (not flashing) for the duration of the Alarm Silence period. In the case of a Low O2 alarm, the alarm will again sound after 30 seconds (if the Low O2 alarm condition still exists); for the other alarms, the alarm remains silent for the duration of the current alarm condition.

1. If the detected oxygen concentration falls below the Low O2 alarm limit set point or below 18%, a high priority alarm is generated:

Audible alarm	- oscillating two-tone (high/low)
Red alarm indicator (LED)	- flashing
Low O2 message	- displayed

2. If the detected oxygen concentration rises above the High O2 alarm limit set point, a less urgent alarm is generated:

Audible alarm	- intermittent low-tone
Yellow Alarm indicator (LED)	- flashing
HIGH O2 message	- displayed

3. As the batteries reach the end of their useful life, the monitor generates two levels of alarm:

   1st LEVEL - CAUTION:

LOW BATT message	- displayed
Yellow alarm indicator (LED)	- lit (continuously)
Audible alarm	- three (3) low-tone beeps

   Although the monitor should continue to operate properly for approximately 6 hours (assumes no use of backlight), replace the batteries to ensure uninterrupted monitoring.

   2nd LEVEL - SHUTDOWN:

Display - Blank	
Audible alarm	- intermittent low-tone
Yellow alarm indicator (LED)	- flashing
LOW BATT message	- displayed

   The monitor indicates a high priority alarm; the batteries must be replaced before the monitor can be used.

4. If the Low O2 alarm limit switch is set below 18%:

Audible Alarm	- three (3) low tone beeps
Yellow alarm indicator (LED)	- lit (continuously)

5. If the sensor assembly is interrupted by component failure or is disconnected:

Audible alarm	- intermittent low-tone
Yellow alarm indicator (LED)	- flashing
Display	- shows 00

6. If the "Watchdog" circuitry detects a computer failure, a System Fail alarm is generated:

Audible alarm	- continuous low-tone
Yellow alarm indicator (LED)	- lit (continuously)
Display	- blank

The monitor cannot be used until repairs are made, refer to the troubleshooting guide (section 5.2) for details.

7. When used in a Modulus II Anesthesia System, the monitor's Batt Power switch should be set to the Off position to conserve the batteries. If, however, the monitor's Batt Power switch is set to the On position while the Modulus II Anesthesia System is in use, the monitor will generate an alarm when the system is turned off, indicating that the monitor remains turned on, under battery power.

Audible alarm	- intermittent low-tone
Display	- shows oxygen concentration

2.5 Calibration

Calibrate the Oxygen Monitor at regular intervals (once each month or as required) using a concentration of oxygen greater than 99% ("100%"). The "100%" O2 calibration is required to verify the linearity of the oxygen sensor.

NOTE: Before calibrating the monitor, turn the monitor on and allow the sensor to stabilize for at least five minutes. The five minute stabilization time assumes that the sensor (cartridge) assembly has been connected to the monitor for at least 12 hours immediately preceding the calibration. In cases where a new sensor cartridge has been installed, the five minute stabilization assumes that the cartridge was removed from its sealed protective packaging just before calibration.

If the sensor assembly has been disconnected for more than five minutes or if the new sensor cartridge has been previously removed from its protective packaging, the monitor must be allowed to stabilize for as many hours as the sensor has been disconnected (or removed from its packaging), up to a maximum of 12 hours. The stabilization is required to remove an oxide layer that accumulates on the galvanic cell of the sensor (if disconnected and exposed to oxygen) impeding the output of the cell.

If in doubt, allow the monitor to stabilize for the presumed time of disconnect and perform the calibration. If the calibration is successful the sensor can be assumed to be linear. However, if the calibration is not successful, allow additional time for the monitor to stabilize (up to 12 hours) and repeat the calibration.

1. Set the HIGH O2 alarm limit switch to "00" to disable the HIGH O2 alarms.
2. Turn the monitor ON and allow it to stabilize (see note above).
3. Introduce the oxygen sensor into a "100%" concentration of oxygen and allow the display to stabilize (approximately two minutes).
4. Adjust the Calibration Control until the display indicates 99% O2.
5. Remove the probe from the "100%" O2 and expose it to room air. The display must stabilize within three minutes and indicate 21% +/- 1 digit.

NOTE: If the display is not within the +/- 1% tolerance range the sensor cartridge is not linear and must be replaced.

6. Set the HIGH O2 alarm limit to "30" (or to a desired High O2 alarm limit) to enable the HIGH O2 alarms.

3.0 OPERATION

This section contains a procedure to help determine that functions of the 5120 Oxygen Monitor are working properly (3.1), and instructions on how to use the monitor effectively (3.2).

3.1 Preoperative Checkout Procedure

To ensure that the oxygen monitor is working properly, make the following checks daily. Also, follow this procedure whenever

- the monitor is returned to clinical use,
- the sensor assembly has been cleaned or replaced,
- the monitor (or sensor) has received a mechanical shock, such as being dropped or severely bumped,
- fresh batteries have been installed.

NOTE: A condensed version of the following procedure is printed on the inside of the monitor's front cover. After you are familiar with this procedure, use the Preoperative Checklist on the cover as a convenient reference to assure yourself that no important steps in the checkout of this monitor have been skipped.

This procedure assumes that the user is familiar with the controls, displays and alarms generated by the monitor. These are explained in detail in Section 2.3.

NOTE: If, during the procedure, the monitor indicates a LOW BATT condition, replace the batteries with three, size C, alkaline batteries as described in section 5.3C and repeat this checkout procedure.

WARNING: If the monitor fails to respond as described in the Preoperative Checkout Procedure, do not use it until the malfunction has been corrected.

1. Place the sensor in room air (21%).
2. Set the Low O2 alarm limit switch to 25.
3. Set the High O2 alarm limit switch to 25.
4. Set the monitor's BATTery POWER switch to On(*).

    a. The display should indicate approximately 21% O2.
    b. The LOW O2 message should be displayed.
    c. The red visual alarm indicator (LED) should flash.
    d. The backlight and the BATT OK message should remain on for approximately five seconds.
    e. The audible alarm should not sound for approximately 30 seconds. After 30 seconds, when the alarm does sound, do not press the alarm silence switch.

(*) If the monitor is installed in a system, such as the Modulus II Anesthesia System, turn the system's power off.

5. When the audible alarm sounds, set the LOW O2 alarm limit to 20 (one digit less than the displayed reading). The audible alarm should turn off.

6. Press and release the Batt. Test switch. The backlight should light and the BATT OK message should be displayed for five seconds. Press the switch again to turn the backlight off.

   Note: If the monitor is connected to an external power source (installed in a system), the backlight is always on.

7. Calibrate the monitor to 21% O2 as follows.
   a. With the sensor in room air (21%) adjust the CALibration control until the display indicates 20% O2.
   b. Then, readjust the control until the display just indicates 21%.

8. Press and hold the Circuit Test switch and note the following.
   a. The alarm tone should beep once.
   b. The display should indicate 88 to 102 % O2.
   c. All messages (4) should be on.
   d. The red and yellow alarm indicators (LEDs) should be on.

   Release the Circuit Test switch, only the backlight and the BATT OK message should remain on for approximately five seconds.

9. Turning both thumbwheels simultaneously, set the Low O2 switch to 19. Then, set the LOW O2 alarm limit switch to 17.
   a. The alarm tone should sound three low-tone beeps.
   b. The yellow alarm indicator (LED) should light and remain lit.

10. Set the LOW O2 alarm limit switch to 22 (one digit greater than the displayed reading).
    a. The audible alarm should sound (oscillating two-tone).
    b. The red alarm indicator (LED) should flash.
    c. The LOW O2 message should be displayed.

11. Press the "alarm silence" switch.
    a. The alarm tone should be silenced for approximately 30 seconds.
    b. The flashing LED should stop flashing (on continuously).
    c. The LOW O2 message should remain on.
    d. After 30 seconds the alarm should again sound (with LED flashing).

12. Set the Low O2 alarm limit switch to 20 (one digit less than the displayed reading). The low O2 alarms should be inactive.

13. Set the High O2 alarm limit switch to 20 (one digit less than the displayed reading).
    a. The audible alarm should sound (intermittent low-tone).
    b. The yellow alarm indicator (LED) should flash.
    c. The HIGH O2 message should be displayed.

14. Set the High O2 alarm limit switch to 22 (one digit greater than the displayed reading). The high O2 alarm should be inactive.

This completes the preoperative checkout procedure.
Set the alarm limit switches to their original setting.

Calibrate the monitor to "100%" oxygen once a month or as otherwise required; refer to Section 2.5.

3.2 Operation

To operate the oxygen monitor effectively the user must:

1. be familiar with its controls (refer to Section 2.3),
2. understand its alarms and indicators (refer to Section 2.4),
3. know how the monitor derives its readings (refer to Section 1.3).

Before using the oxygen monitor, perform the Preoperative Checkout Procedure to ensure that the monitor is working properly, refer to Section 3.1.

Calibrate to room air (21%) daily (Step 7 of Preoperative Checkout Procedure) or whenever the monitor is returned to clinical use.

Once a month, or as required otherwise, calibrate the monitor to "100%" O2 to verify the linearity of the oxygen sensor, refer to Section 2.5.

NOTES ON APPLICATION

When the oxygen sensor is used in the patient circuit of a ventilator or an anesthesia gas machine, water vapor will condense on the surface of the sensor if the sensor's temperature is lower than or equal to the dew point temperature of the breathing gas. The condensate acts as an additional diffusion resistance and may result in a lower than actual O2 concentration display.

CAUTION: When in use, the sensor should always be pointing down to reduce moisture build-up on its sensing surface.

In the patient circuit of a ventilator, place the sensor ahead of the breathing gas humidifier.

Continuous exposure of the oxygen sensor to CO2 gas mixture can reduce the service life of the oxygen sensor (ACCURACY OF READINGS IS NOT AFFECTED). The service life of the sensor is 5000 percent hours - CO2. Using the sensor in a gas mixture containing 1% CO2 for five hours would reduce the service life of the sensor by 0.1%. However, since the sensor should preferably be located in the inspiratory section of the patient circuit, service life reduction as a result of CO2 is minimal.

NOTE: The oxygen monitor provides information on the presence of oxygen at the point of sensing. This is not necessarily the same percentage that is present throughout the patient circuit.

OPERATION

1. Insert the oxygen probe into the gas stream to be monitored; a 22mm tee manifold is supplied with the monitor, a Dome Adapter Kit for the inhalation check valve of an Ohmeda (Ohio) Absorber is optional.

   Attach the female end of the Tee manifold to an appropriate 22mm outlet (such as the inspiratory outlet of a CO2 absorber).

   Attach the patient breathing circuit to the male end of the manifold.

   Insert the oxygen sensor probe into the 15mm port. Mount the sensor vertically, with the sensor opening facing down and the cord end facing up.

CAUTION: When in use, the sensor should always be pointing down to reduce moisture build-up on its sensing surface.

2. Turn the monitor On. The audible alarm is silenced for approximately 30 seconds after turn on; this allows you time to tailor the alarm limits to the current oxygen concentration without the intrusion of an audible alarm.

3. Set the Low O2 and the High O2 alarm limit switches to the desired alarm points. The alarms will be activated when the display indicates an O2 concentration one digit less than or greater than the selected limits.

4. Continue using the monitor for as long as required.

   a. If the monitored oxygen concentration drops below the selected Low O2 limit or below 18%, an oscillating two-tone alarm sounds, the red alarm indicator (LED) flashes, and the LOW O2 message is displayed.

   b. If the monitored oxygen concentration exceeds the selected High O2 limit, an intermittent low-tone alarm sounds, the yellow alarm indicator (LED) flashes and the HIGH O2 message is displayed.

Note: The audible alarm can be silenced using the alarm silence switch (Low O2 alarm will silence for 30 seconds; other alarms will silence until the next occurrence). The visual alarms cannot be turned off: they are active throughout the alarm condition.

5. Alarm limits can be changed while the monitor is in operation. Setting the Low O2 alarm limit below 18% results in a continuous yellow alarm indicator (preceded by 3 beep tones).

6. THINGS TO REMEMBER:

   a. If the LOW BATT message appears, the batteries are reaching the end of their useful life. Replace the batteries (three, size C, alkaline) as described in Section 5.3C.

   b. If sensor assembly is disconnected from the monitor, allow five minutes to stabilize the sensor after the sensor assembly is reconnected. Do not disconnect the sensor between cases or for overnight storage. Refer to the NOTE on page 28.

7. After use, turn the monitor off and follow the cleaning and sterilization procedures in Section 4.1 that apply to your situation.

Chart 1.
Operation: Summary of Displays, Alarms and Indicators

Response → / Condition ↓	Audible Alarm	LED	Message				Display	Backlight	Comments	*Notes
			High O_2	Low O_2	Batt OK	Low Batt				
Turn Monitor on	Short Beep *	Both LEDs on briefly			ON for 5 sec		%O_2	ON for 5 sec	Monitor ready for use. If sensor disconnected, allow 5 min. to stabilize	*Audible alarm silenced for 30 seconds to allow initial adjustments
%O_2 less than Low O_2 Set, or less than 18%	Oscillating Two-Tone *	Red Flashing		ON			%O_2		Low O_2 Alarm Condition	*Audible alarm can be silenced for 30 seconds
%O_2 greater than High O_2 Set	Intermittent Low-Tone *	Yellow Flashing	ON				%O_2		High O_2 Alarm Condition	*Audible alarm can be silenced for duration of alarm condition
Low O_2 alarm limit set below 18	Three Low-Tone Beeps	Yellow Continuous					%O_2		Monitor indicates CAUTION when Low O_2 set below 18	
High O_2 set to "00"	*	*	**				%O_2		High O_2 alarms disabled	*Alarms disabled for High O_2 condition **High O_2 not displayed
Batt Test					ON for 5 sec	*	%O_2	ON	Press Batt Test switch to turn off backlight	*If Batt low, replace batteries
Circuit Test	*	Red & Yellow Continuous	ON	ON	ON	ON	88 to 102	ON for 5 sec	"Circuit Test" only while switch depressed. Goes to "Batt Test" when switch released	*Audible alarm silenced for 5 seconds
Low Battery Voltage	Three Low-Tone Beeps	Yellow Continuous				ON	%O_2		Replace batteries to ensure uninterrupted monitoring of patient	
Discharged Batteries (Shutdown)	Intermittent Low-Tone *	Yellow Flashing				ON	Blank		Monitor in "Shutdown" mode. Replace Batteries	*Audible alarm can be silenced for duration of alarm condition
Sensor disconnected or defective	Intermittent Low-Tone *	Yellow Flashing					00		Display set to 00 to show problem with sensor	*Audible alarm can be silenced until good SENSOR is reconnected
System Failure	Continuous Low-Tone *	** Yellow Continuous					Blank		Turn unit off, then on. Computer may Recover	*Audible alarm cannot be silenced ** Red LED may also light for some System failures
Ext. Power Removed when Batt Power Switch is On	Three Low-Tone Beeps	Yellow Continuous					%O_2		Monitor will continue to function; however, Batt power switch should be off when using external power	*Audible alarm can be silenced for duration of alarm condition

4.0 OPERATOR MAINTENANCE

Calibrate the 5120 Oxygen Monitor at regular intervals (once each month or as otherwise required) using a concentration of oxygen greater than 99% ("100%"), refer to Section 2.5. The "100%" O2 calibration is required to verify the linearity of the oxygen sensor, thereby assuring the specified accuracy of the monitor throughout the range of the readings.

Cleaning and sterilization recommendations are covered in Section 4.1.

The batteries and the oxygen sensor cartridge are expendable items and have a limited service life; replacement procedures for these items are covered in Section 5.0, Service Procedures.

The service life of the batteries depends on their condition when installed and the accumulated use-time of the monitor. To realize maximum use of the monitor between battery changes, always replace batteries only with "fresh", size C, alkaline batteries.

The service life of the oxygen sensor is affected by several factors; refer to the introduction on page 1 to realize maximum service life. If the monitor cannot be calibrated to 21% in room air or if the deviation is excessive when the "100%" O2 calibration is performed, replace the sensor cartridge.

NOTE: If the monitor requires additional service or repair, refer to the Repair Policy and Procedure in Section 5.1.

4.1 Cleaning and Sterilization

All parts of the oxygen monitor (with the exception of the sensor cartridge, refer to section 4.1C) can be cleaned with a cloth moistened in a mild liquid detergent solution (wetting agent). Isopropyl alcohol can be used if further cleaning is required.

CAUTION: Use the recommended cleaning solution sparingly; do not saturate or immerse the monitor.

Sterilization of the various parts of the monitor is divided into three sections:

A. Monitor assembly (electronics package),
B. Sensor assembly (less cartridge) and the tee manifold,
C. Sensor cartridge.

Each part has individual sterilization requirements; treat each part separately to ensure that they continue to function properly after sterilization.

NOTE: After cleaning and sterilization perform the Preoperative Checkout Procedure in Section 3.1 to verify that the monitor is functioning properly.

WARNING: If the monitor fails to respond as described in the Preoperative Checkout Procedure, do not use it until the malfunction has been corrected.

A. Monitor Assembly

In most cases, cleaning the monitor assembly with liquid detergent is sufficient. If required, the monitor may be wiped with a cloth moistened in disinfectant (cold sterilant).

CAUTION: Use the recommended cleaning solution sparingly; do not saturate or immerse the monitor.

CAUTION: Do not gas sterilize the monitor.

CAUTION: Do not autoclave the monitor.

B. Sensor Assembly (less cartridge) and Tee Manifold

Clean the sensor assembly and the sensor cartridge separately. To remove the sensor cartridge follow the instructions in Section 5.3B.

In use, the front housing of the sensor probe and the sensor cartridge (screened surface) are the only parts of the sensor assembly that are exposed to the patient circuit.

1. Probe housing, rear half (includes cable assembly)

   NOTE: Do not immerse the rear housing in cleaning solution.

   The rear housing contains electrical contacts that do not require cleaning under normal use. If required, the rear probe housing and cable assembly may be wiped with a cloth moistened in disinfectant (cold sterilant).

2. Probe housing, (front half only) and tee manifold
   The front probe housing and the tee manifold can be gas sterilized using an ethylene oxide mixture (low temperature method only).

CAUTION: Following sterilization of the probe housing (front half only) or the tee manifold with ethylene oxide, quarantine parts to allow dissipation of residual ethylene oxide gas absorbed by the material. Follow sterilizer manufacturer's recommendations for procedure and aeration period.

C. Sensor Cartridge

The sensor cartridge should not be cleaned or sterilized routinely, however, if it is necessary to do so, follow these recommendations.

NOTE: To avoid damaging the sensor cartridge handle it with care.

1. Remove salt deposits and dirt accumulation from the sensor with a cloth moistened in distilled water.
2. If required, isopropyl alcohol can be used in place of water.
3. DO NOT cold sterilize (disinfect) the sensor cartridge.
4. DO NOT use solvents or cleaning agents other than water or isopropyl alcohol.

NOTE: The sensor cartridge may be gas sterilized using an ethylene oxide mixture (low temperature method only).

CAUTION: Following sterilization of the sensor cartridge with ethylene oxide, quarantine parts to allow dissipation of residual ethylene oxide gas absorbed by the material. Follow sterilizer manufacturer's recommendations for procedure and aeration period.

5.0 SERVICE PROCEDURES

Service, other than what is described in this manual, must be performed by a technically competent individual as described in the Service Manual for this product.

The operator can repair a malfunctioning 5120 Oxygen Monitor if the cause of the malfunction is any of the items listed in Section 5.4, and detailed in Section 5.3.

To determine which component is defective, refer to the troubleshooting guide in Section 5.2.

NOTE: If the monitor requires additional service, refer to the Repair Policy and Procedure in Section 5.1.

5.1 Repair Policy and Procedure

Do not use malfunctioning equipment. Warranty repair and service must be performed by an Ohmeda Service Representative or at the Ohmeda National Service Center at the address listed below.

Make all necessary repairs or have the equipment repaired by an Ohmeda Service Representative. Parts listed in the service manual, for this product, may be repaired or replaced by a competent, trained person who has experience in repairing devices of this nature. After repair, test the equipment to ascertain that it complies with the published specifications.

CAUTION: Only competent individuals trained in the repair of this equipment should attempt to service it.

CAUTION: Detailed information for more extensive repairs is included in the service manual solely for the convenience of users having proper knowledge, tools and test equipment, and for service representatives trained by Ohmeda.

Contact the nearest Ohmeda Regional Service Office, listed on the back cover, for assistance.

If you send the monitor to the Ohmeda National Service Center, package it securely, in the original shipping container if possible, and ship it prepaid. Enclose the following five items:

1. A letter describing in detail any difficulties experienced with the monitor.
2. Warranty information -- a copy of the invoice or other applicable documentation must be included.

3. Purchase order number to cover repair.
4. Ship to and bill to information.
5. Person (name and telephone number) to contact for functional questions.

In all cases, other than where Ohmeda's warranty is applicable, repairs will be made at Ohmeda's current list price for replacement part(s) plus a reasonable labor charge.

Ohmeda National Service Center
4507-C Mills Place
Atlanta, GA 30336

5.2 Troubleshooting Guide

When a problem with the 5120 Oxygen Monitor is apparent, first perform the Circuit Test, listed below, to isolate the problem.

Circuit Test:

Press and hold the Circuit Test switch on the front panel of the monitor.

Verify that the following occurs:

-- the audible alarm sounds one beep,
-- the display indicates between 88 and 102 %O2,
-- the red and yellow alarm indicators (LEDs) are lit, and
-- all alarm messages (4) are displayed.

If the monitor responds as listed, the apparent problem is sensor related. Refer to the troubleshooting Chart 2, on page 41, to help isolate the cause of the malfunction.

Locate in the left-hand column a "Symptom" that describes the apparent malfunction. Possible causes of the malfunction are listed in probable order. Follow the solutions in the right-hand column to restore the monitor to working order.

If the monitor does not respond as listed, the malfunction is internal to the monitor assembly. Refer to the Repair Policy and Procedure in Section 5.1(*).

(*) Appendix B details a "System Test" procedure built into the monitor. The test is an aid for a qualified service person to further isolate the apparent malfunction.

Chart 2
Troubleshooting Guide

Symptom	Possible Cause	Recommended Action
No displays or alarms are generated	Batteries completely discharged	Replace batteries (Section 5.3C)
Display - "00" intermittent low-tone, yellow LED flashing	Sensor assembly disconnected	Verify sensor connector is secure in modular jack (Section 5.3A)
	Sensor cartridge defective	Replace sensor cartridge (Section 5.3B)
	Sensor assembly defective	Replace sensor assembly (Section 5.3A)
Cannot calibrate to room air (21% O2)	Sensor cartridge defective	Replace sensor cartridge (Section 5.3B)
	Sensor Assembly defective	Replace sensor assembly (Section 5.3A)
Yellow LED lit (3 beep tones), but no message	Low O2 limit switch set below 18%	Set Low O2 limit at 18% or higher
High O2 alarms not active	High O2 limit switch set to "00".	Normal: Setting High O2 switch to "00" disables High O2 alarm. Refer to Section 2.3,Item 4
Continuous low-tone, yellow LED lit, display blank	External electrical interference	Turn monitor Off then, On again
SYMPTOM NOT LISTED	Defective batteries	Replace batteries (Section 5.3C)
	Internal malfunction.	Refer to Repair Policy and Procedure (Section 5.1)
Intermittent low-tone, no message or LED	External power was turned off while BATT POWER was ON	Set BATT POWER switch to OFF

5.3 Parts Replacement Procedures

This section includes replacement procedures for

- parts that are consumed in use (expendable),
- parts whose failure can be easily diagnosed by the operator and whose replacement does not require extensive service skills.

Operator replacement parts are listed in Section 5.4.

If further service of the monitor is required, refer to Section 5.1, Repair Policy and Procedure.

A. How To Replace Sensor Assembly

Note: The sensor assembly consists of the housing (probe) for the oxygen sensor cartridge, the coiled cable, and the connector which joins the sensor assembly to the monitor. The sensor cartridge is not included in the replacement sensor assembly; it must be transferred from the old assembly or a new cartridge must be installed (refer to Section 5.3.B).

The sensor assembly is attached to the monitor through a modular jack.

To disconnect the sensor assembly:

1. Push the release tab toward the cable and gently pull the connector (cable) from the monitor.

To connect the sensor assembly:

1. Align the cable connector with the modular jack (release tab down).
2. Gently push the connector into the jack. The release tab should snap into place.
3. Gently pull on the cable to verify a secure connection.

CAUTION: After replacing the probe assembly, perform the Preoperative Checkout Procedure in Section 3.1 to verify that the monitor is working properly; allow at least five minutes to stabilize the sensor; refer to the NOTE on page 28.

B. How To Replace Sensor Cartridge (refer to Figure 12 on page 45)

The oxygen sensor cartridge is located inside the probe housing. Tools are not required to replace the sensor.

NOTE: To avoid damaging the sensor cartridge handle it with care.

To remove the sensor module,

1. Hold each half of the probe assembly at the knurled surfaces.
2. Unscrew the front housing half (the one without the cable attached) in a counterclockwise direction to open the housing.
3. Hold the rear housing with the cable connection down and spin off the front housing.
4. Note the appearance of the forward (exposed) surface of the sensor. This is the portion of the sensor that analyzes the oxygen concentration.
5. Lift the sensor out of the rear housing.

To replace the sensor module,

1. Hold the rear housing with the cable connection down.
2. Note the three, gold-colored terminals in the rear housing. The sensor mates to these terminals through three concentric rings.
3. Place the sensor into the rear housing. The rings must face into the housing to form an electrical contact with the terminals. The screened surface must face out to be exposed to the environment.
4. Thread the front housing into the rear housing to capture the sensor and hold it into place.
5. Turn the front housing clockwise until it "bottoms out."
6. Twist the housing halves further (finger tight) to compress the o-rings, and to form a mechanical and gas tight seal.

CAUTION: After replacing the sensor assembly, perform the Preoperative Checkout Procedure in Section 3.1 to verify that the monitor is working properly; allow at least five minutes to stabilize the sensor: refer to the NOTE on page 28.

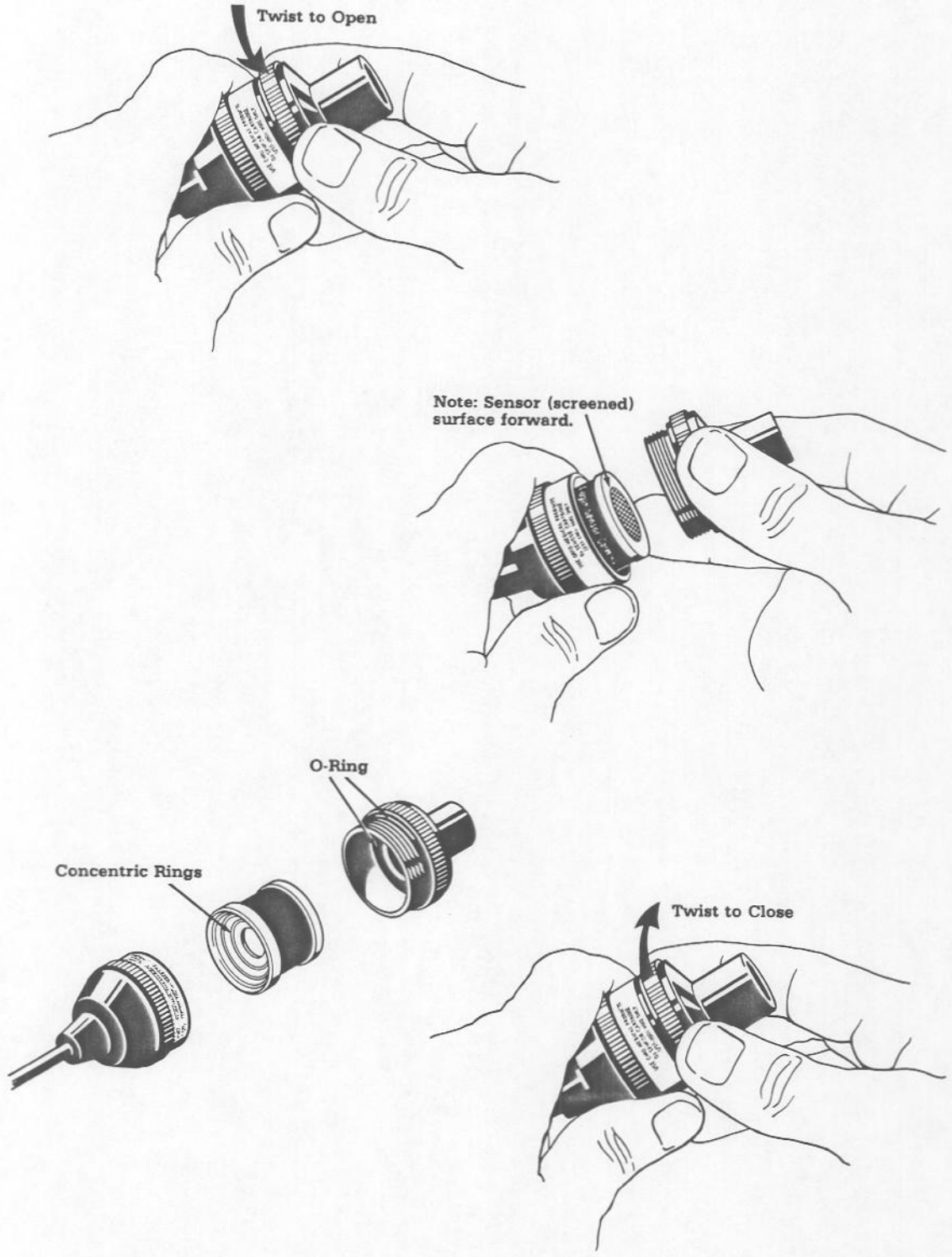


Figure 12. Replacing Sensor Cartridge

C. How to replace batteries

The monitor is powered by three, size C, alkaline batteries. In use, batteries discharge and eventually require replacement. The monitor contains circuitry that checks the condition of the batteries, and generates messages and alarms that indicate when the batteries must be replaced. Section 2.3 (Items 1A and 3b) details the operation of the various battery test features.

When battery replacement is required,

1. Turn the monitor Off.

2. The battery compartment is located behind the front cover. Pull the front cover forward to gain access to the batteries.

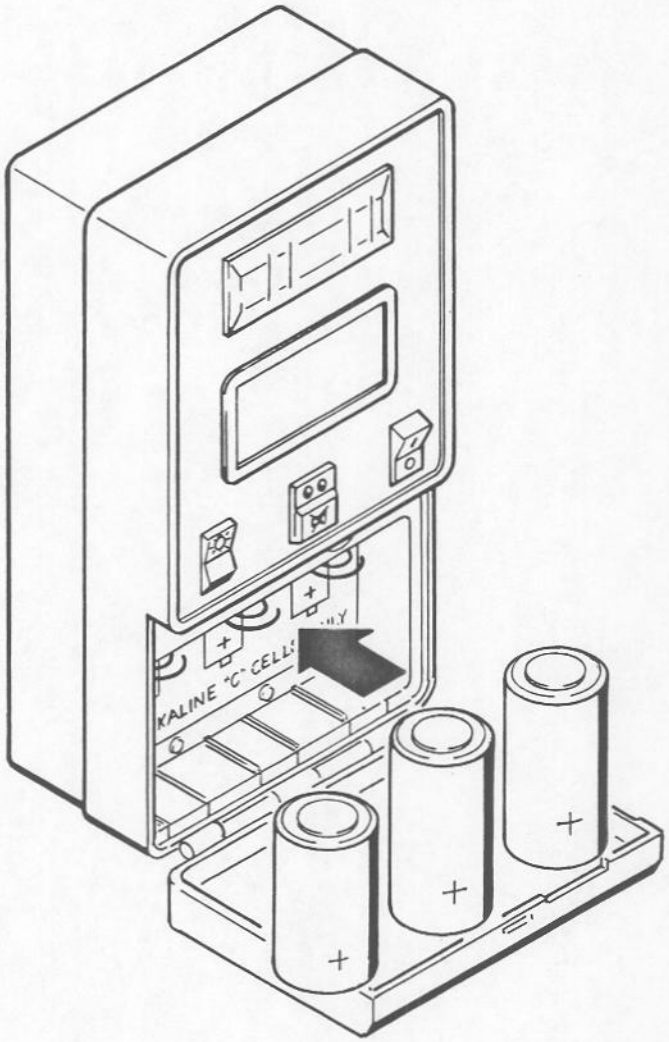
3. Remove and safely dispose of the spent batteries. **Do not incinerate.**

4. Observing the correct polarity (refer to Figure 13 on page 47) install three "fresh", size C, alkaline batteries.

5. Snap the front cover back into place.

6. Turn the monitor On. A "BATT OK" message should be displayed for approximately five seconds.

CAUTION: After fresh batteries are installed, perform the Preoperative Checkout Procedure in Section 3.1, to verify that the monitor is working properly.

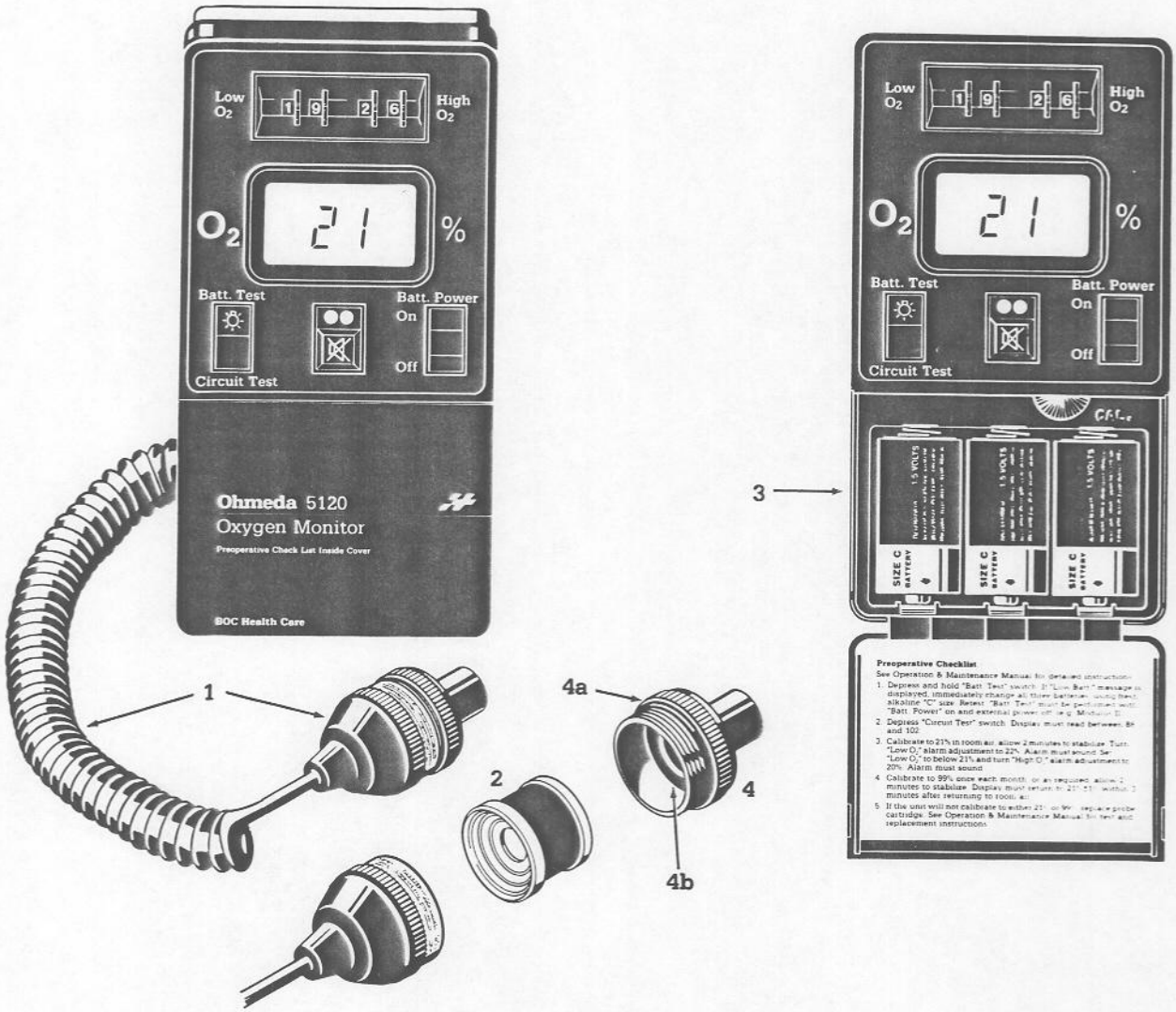


Note: Install batteries individually, with positive terminal facing down.

Figure 13. Battery Replacement

5.4 Replacement Parts List

Refer to Section 5.3 for Replacement Procedures



ITEM	DESCRIPTION	STOCK NUMBER
1	Sensor Assembly (does not include Item 2)	0237-2030-700
2	Sensor Cartridge	0237-2034-700
3	Batteries (3), size C, alkaline	Obtain locally
4	Front Housing with O-rings	0237-2035-800
4a	O-ring (outside)	0210-0503-300
4b	O-ring (inside)	0210-0499-300

Figure 14. Replacement Parts

APPENDIX A

Output Connector:

The output connector provides remote access to three functions of the 5120 Oxygen Monitor:

A.) - an analog output of the displayed percentage of oxygen,

B.) - a digital output indicating a sensed alarm condition, and

C.) - a connection for silencing the audible alarm from a remote location.

Refer to Figure 15 on page 51 for pin assignments.

A. Analog Output:

The output voltage ranges from 0 to 1.0 volt full scale. Each 10 millivolt increment corresponds to a 1% change in oxygen concentration; for example, the voltage at the output connector (pin 5) is 0.5 volts when 50% O2 is displayed.

NOTE: This is a calibrated output. If the monitor is calibrated, the output is calibrated.

The analog output circuit has a series resistance of 100 ohms to limit the output current. To maintain the stated calibration of 10 mV per % O2, the load impedance of the remote monitor (recorder) must be at least 10 K ohms.

WARNING: Connect only a high impedance device (at least 10 K ohms) to pin 5 of the output connector. Improper loading will result in an output voltage that is lower than the corresponding value displayed by the oxygen monitor.

Note: The accuracy of the displayed reading is not affected by the load at the output connector. Improper loading only affects the output voltage.

To connect a low impedance device to the analog output a high impedance buffer amplifier must be used as an interface.

B. ALARM OUTPUT:

An alarm output signal is provided for remote monitoring. The output from pin 6 to pin 3 is high (> 4.5 volts) when no alarm condition exists. When an alarm condition occurs, the alarm output emits a series of pulses corresponding to the specific alarm condition.

Refer to Table 1 below for possible alarm conditions and the number of pulses transmitted to signify the specific condition. Each pulse is nominally 10 msec wide with a 20 msec period. The cycle of pulses is repeated every 320 msec, until the alarm condition changes. The alarm output can source or sink up to 1 milliamp. It is driven by a transient-protected CMOS gate having a signal voltage swing of 0 to +5 volts.

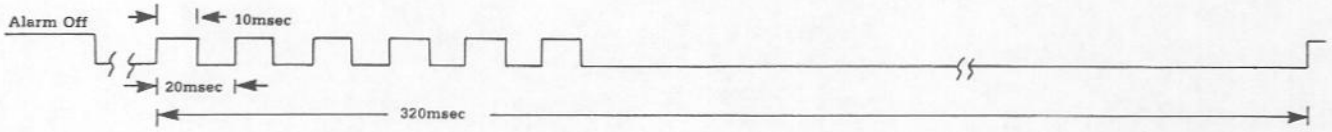


Table 1
Remote Alarm Pulse Code

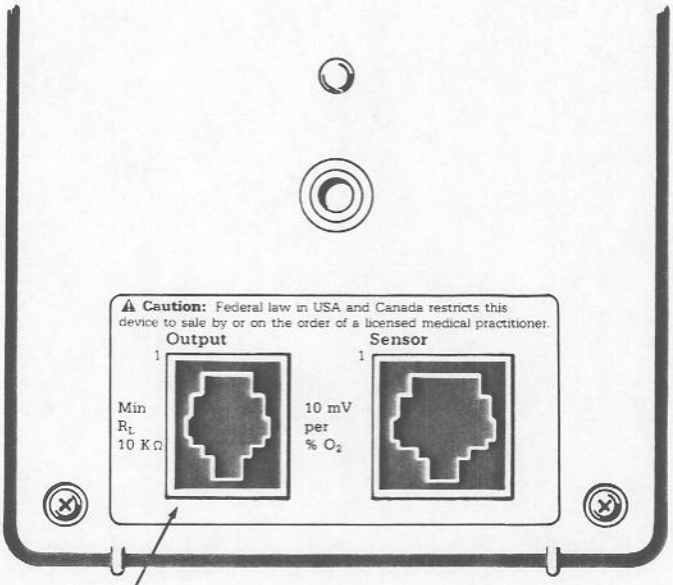
Number of Pulses	Alarm Condition	Priority
1	LOW O2	1
2	HIGH O2	2
3	"00" %O2 displayed	3
4	Discharged batteries	4
5	Low O2 limit < 18%	5
6	LOW BATT	6

Note: If more than one alarm condition exists, the condition with the highest priority (lowest number) will be transmitted.

Note: The Alarm Output signal will remain low (< 0.5 volts) for most of the time that the alarm condition exists. Therefore, if alarm decoding is not required, a simple lamp, controlled by a low level signal, can be used to indicate an alarm condition.

C. EXTERNAL ALARM SILENCE:

An input is provided for remote alarm silencing. A normally open switch connected between pin 4 and pin 3, when closed, will silence the audible alarm just as the "alarm silence" switch on the front of the monitor. The input is high-to-low sensitive: a continuous low input will not maintain an alarm silence. The input is a transient-protected CMOS input. A maximum input voltage of 5.5 and a minimum of -0.5 volts are allowed.



Pin 1 - Analog Ground
Pin 2 - Shield Ground
Pin 3 - Digital Ground
Pin 4 - External Alarm Silence Input
Pin 5 - Analog Output, 10 mV per %O2, 10 K ohms minimum load
Pin 6 - Digital Alarm Output

Figure 15. Rear View

APPENDIX B

System Test Mode:

The 5120 Oxygen Monitor includes a System Test procedure which tests four functions within the monitor: display segments (digits and messages), Low O2 switch, High O2 switch, and the terminal voltage from the batteries.

To perform the system test,

(1.) Set the monitor's BATTery POWER switch to On.

To enter the System Test mode, press the Circuit Test and the "alarm silence" switches simultaneously.

The first test checks the individual segments of the LCD display. Verify that all segments of the two digits and the four messages flash simultaneously.

(2.) Press the "alarm silence " switch to enter the next test.

Low O2 limit switch test: A number equal to the value set by the Low O2 switch should be displayed on the LCD display. Changing the setting should cause a corresponding change on the display. Note: Any setting less than 10 will appear as 10 on the display. This is to show that the monitor does not accept Low O2 limits below 10%.

(3.) Press the "alarm silence" switch to enter the next test.

High O2 limit switch test: A number equal to the value set by the High O2 switch should be displayed on the LCD display. Changing the setting should cause a corresponding change on the display.

(4.) Press the "alarm silence" switch to enter the next test.

Battery Voltage test: The number displayed is 10 times the combined voltage of the three batteries in series. Nominally, fresh batteries should display 45 (that is, 1.5 volts x 3 batteries x 10).

Press the "alarm silence" switch to exit the System Test mode and return to normal operation.

Note: The monitor will automatically return to normal operation two (2) minutes after entering the System Test Mode.

If the monitor fails any of these tests, remove it from use until the malfunction has been corrected.

WARRANTY

This Product is sold by Ohmeda under the warranties set forth in the following paragraphs. Such warranties are extended only with respect to the purchase of this Product directly from Ohmeda or Ohmeda's Authorized Dealers as new merchandise and are extended to the first Buyer thereof, other than for purpose of resale.

For a period of twelve (12) months from the date of original delivery to Buyer or to Buyer's order, but in no event for a period of more than two years from the date of original delivery by Ohmeda to an Ohmeda Authorized Dealer, this Product, including its oxygen sensor cartridge, but excluding all other expendable parts, is warranted to be free from functional defects in materials and workmanship and to conform to the description of the Product contained in this operation manual and accompanying labels and/or inserts, provided that the same is properly operated under conditions of normal use, that regular periodic maintenance and service is performed and that replacements and repairs are made in accordance with the instructions provided. This same warranty is made for a period of thirty (30) days with respect to the expendable parts, other than the oxygen sensor cartridge. The foregoing warranties shall not apply if the Product has been repaired other than by Ohmeda or in accordance with written instructions provided by Ohmeda, or altered by anyone other than Ohmeda, or if the Product has been subject to abuse, misuse, negligence, or accident.

Ohmeda's sole and exclusive obligation and Buyer's sole and exclusive remedy under the above warranties is limited to repairing or replacing, free of charge, at Ohmeda's option, a Product, which is telephonically reported to the nearest Ohmeda Regional Service Office and which, if so advised by Ohmeda, is thereafter returned with a statement of the observed deficiency, not later than seven (7) days after the expiration date of the applicable warranty, to the designated Ohmeda Service Office during normal business hours, transportation charges prepaid, and which, upon Ohmeda's examination, is found not to conform with the above warranties. OHMEDA SHALL NOT BE OTHERWISE LIABLE FOR ANY DAMAGES INCLUDING BUT NOT LIMITED TO INCIDENTAL DAMAGES, CONSEQUENTIAL DAMAGES, OR SPECIAL DAMAGES.

THERE ARE NO EXPRESS OR IMPLIED WARRANTIES WHICH EXTEND BEYOND THE WARRANTIES HEREINABOVE SET FORTH. OHMEDA MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE PRODUCT OR PARTS THEREOF.

Note: Batteries are not covered by warranty due to the varying battery life dependent on the unit's usage.

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